

from the 12th to the 13th, but the general distribution of pressure and direction of wind at the Rocky mountain stations, did not warrant the continuation of the track of this depression as a part of that traced as iv. A severe tornado occurred in St. Clair county, Michigan, on the 8th, when the pressure was lowest near Salt Lake City, but an examination of the weather chart of that date indicated the presence of a slight depression in the upper Mississippi valley, with northerly winds over Lake Superior and southerly winds in eastern Iowa and southern Illinois. Very heavy winds occurred in Iowa on the 10th, when the barometer was lowest in Colorado.

IV.—This depression was central in eastern Colorado on the morning of the 13th; the barometer at Denver reading 29.62, and that of Cheyenne, 29.63, with northerly winds and light rain. This depression extended in a north and south direction, from Texas to northern Dakota, the winds being from east to south in the Mississippi and Missouri valleys, accompanied by light rains. This area moved northward into western Nebraska during the day, enclosed by an elliptical isobar, the longer axis of which inclined slightly to the east, and extended from Santa Fé to Bismarck. The course changed to the eastward during the night of the 13th, and the centre passed over southern Minnesota, central Wisconsin, and the southern part of Lake Superior on the 14th, the storm increasing in force and becoming more contracted as it approached the lake region. The rain-area of this depression extended over the states north of the Ohio valley, but the amount of precipitation was slight. After passing to the east of the lake region over the Saint Lawrence valley, the pressure diminished at the centre, and the disturbance became more extended; rain fell in New England and the middle Atlantic states as the centre of this disturbance passed to the eastward and northward of these districts. At the 7 a. m. report of the 16th, when the centre of disturbance was near Farther Point, the barometer at that station read 29.41; the following maximum velocities of wind were reported at stations on the lakes: Milwaukee, 36; Grand Haven, 38; Port Huron, 36; Sandusky, 25.

V.—This depression developed rapidly during the 16th, and was probably central near the western part of Lake Superior on the morning of that date. At the p. m. report of the 16th, it was central in Wisconsin as a slight disturbance, causing light rains in the upper lake region and thence southward to the Ohio valley. This depression moved southeasterly until the centre reached Lake Huron on the morning of the 17th, when the a. m. weather chart exhibited a trough of low pressure, extending from the upper Saint Lawrence to the upper Missouri valley. This area became less defined during the 17th, and finally disappeared to the northeast of Lake Huron, the course changing after the morning report of that date. Light rains occurred in all districts east of the Mississippi on the 17th, when this depression was moving to the northeast of the lakes.

VI.—This depression was first observed as central in Dakota, at the midnight report of the 16th. It became more clearly defined during the 17th, as the centre moved in a southeasterly direction, enclosed by an isobar of 29.50, at the p. m., report of the 17th. At midnight of the 17th, the centre of this storm had reached northern Iowa, the barometer at Des Moines reading 29.34, wind w.; Omaha, 29.44, wind nw.; Saint Paul, 29.42, wind e.; Huron, Dakota, 29.46, wind nw.; at this report, the depression was elliptical in form, the longer axis being in a north and south direction, inclining slightly to the westward. On the 18th the centre passed to the northeast near Saint Paul, where the barometer fell to 29.24 at the 7 a. m., report, and at the same report, the observer at Duluth reported barometer 29.41, violent ne., gale and heavy rain. This storm passed directly eastward over Lake Michigan, causing severe gales, and heavy rains; after passing to the eastward of the lake region, the pressure increased at the centre, and the storm lost much of its energy before passing beyond the limits of observation. The succeeding reports indicate that it disappeared as a slight disturbance, northeast

of Nova Scotia on the 20th. Under the heading of local storms, will be found a description of the tornadoes which occurred while this depression was passing over the northern part of the United States.

VII.—This depression was first observed in the upper Missouri valley on the morning of the 19th. The pressure continued below the normal in this region during the 19th and 20th, when the centre of low pressure moved southward to Colorado, leaving a slight secondary depression in Dakota, on the afternoon of the 20th. This depression continued in Colorado until the midnight report of the 21st, when it disappeared before reaching the Missouri valley.

VIII.—Was central north of Lake Superior on the 24th, and passed eastward over the lower Saint Lawrence valley, causing only a slight disturbance in northern districts of the United States. It was at no time within the limits of the Signal Service stations, and the position of the centre is only approximately located at the tri-daily telegraphic reports.

The following report furnished by Captain Moody, of the s. s. "State of Georgia," probably indicates the presence of this storm: 26th, in N. $41^{\circ} 01'$, W. $56^{\circ} 27'$, barometer 29.76, wind sw., force 7, heavy rain.

IX.—An extended area of low pressure was central in the southern plateau region, on the morning of the 27th; this depression moved slowly to the eastward over Utah and Colorado, during the 27th and 28th, when its course changed to the north. On the morning of the 29th, it was central near Deadwood, Dakota, where the barometer was slightly below 29.70; on this, and the following day, this disturbance moved directly eastward over the lake region, with increasing energy and at the close of the month, it was central near Saugeen, where the barometer read 29.57. Cautionary signals were ordered at stations on Lakes Michigan, Huron, and Erie, in advance of this storm; these signals were justified by dangerous winds on Lakes Erie, and Huron, but they were not justified at stations on the southern and western shores of Lake Michigan.

INTERNATIONAL METEOROLOGY.

International charts iv. and v. accompany the present number of this REVIEW. Chart iv. is published for April, 1880, and continues the series of that chart begun in January, 1877. Chart v. is prepared for July, 1880, and continues the series of that chart from November, 1877. In the description of these charts, much valuable information has been obtained from the "Monatliche Uebersicht der Witterung," published by Prof. Dr. G. Neumayer, Director of the German Marine Observatory, and from the "Bulletin Mensuel," published by Mr. Marc Dechevrens, of Zi-Ka-Wei, China.

Chart iv. exhibits the mean pressure, mean temperature and prevailing direction of the wind over the northern hemisphere for the month of April, 1880, as determined from one observation taken each day at 7.35 a. m. or 0.43 p. m., Greenwich mean time.

The area of lowest mean pressure occupies southeastern Greenland, the mean pressure at Godthaab being 29.54 (750.3 m. m.), prevailing wind, south, force 4. The barometric gradients increase slowly toward the east and southeast, but in the south the increase is more rapid.

A second area of mean low barometer extends over British India, where the lowest mean pressure for the month was 29.63 (752.6 m. m.).

An area of relatively mean low pressure, 29.90 (759.4 m. m.), extends over the United States from the lake region southward and westward to the Rocky mountains.

The isobar of 29.90 (759.4 m. m.) also covers the European continent from northern Russia southward to the Black sea and the Mediterranean, and westward to the North sea and Bay of Biscay.

Three areas of barometric maxima appear on the chart.

The first area of mean high barometer, 30.20 (767.7), is that of the Atlantic, which extends over the ocean between the

parallels of 20° and 40° N., and between the meridians of 20° and 50° W.

In Asia, the isobar of 30.10 (764.5) appears in southern Siberia, and encloses the provinces of Tomsk and the southern part of Yeneseisk. An area of high pressure, 30.10 (764.5), also covers the eastern part of China, while a second area of 30.10 extends from the western coast of Japan northwestward over Korea toward Irkutsk.

In North America, the high area of the Pacific appears over California, where the mean pressure ranges from 30.04 (763.0) to 30.10 (764.5), and the isobar of 30.00 (762.0) covers the territory from Manitoba northward to Hudson's Bay.

Compared with the preceding month, the pressure has remained nearly stationary over Greenland, the mean barometer being 0.01 inch below the mean for March. The pressure has increased over Russia; the area of low barometer 29.60 (751.8), which was central over that country during March, is, this month, replaced by the isobars of 29.90 (759.4), and 30.00 (762.0).

In central Europe, the pressure has decreased, the isobars of 30.20 (767.1), and 30.10 (764.5) of March, being now replaced by the isobar of 29.90 (759.4).

In eastern Asia, the pressure has averaged about 0.10 inch below the mean for March, while the area of 30.20 (767.1) has moved into Siberia.

In the United States, the pressure has generally decreased throughout the country, except in Florida and in parts of Alabama and Georgia. On the north Pacific coast, the pressure was about 0.07 inch below the mean of the preceding month.

Compared with the corresponding month of previous years, the pressure was below the normal in Iowa, Minnesota, and the lake region, while it was correspondingly above the normal in the middle and south Atlantic states and in Georgia and Alabama. On the north Pacific coast, a deficiency occurred, ranging from 0.02 to 0.09 inch, while in California, the pressure was from 0.02 inch to 0.11 inch above the normal. In Canada, the pressure was generally below the normal.

The following table exhibits the mean pressure and the mean temperature for the month of April 1880, in the several countries of Europe and Asia, compared with the means as determined from observations taken during April, 1877, 1878, and 1879.

Countries.	Mean Barometer.			Mean Temperature.		
	April, 1877, 1878 and 1879.	April, 1880.	Depart- ure.	April, 1877, 1878 and 1879.	April, 1880.	Depart- ure.
Algeria.....	29.97	29.98	+0.01	66.6	67.3	+ 0.7
Austria.....	29.76	29.68	-0.10	56.3	61.6	+ 5.3
British Isles.....	29.78	29.85	+0.07	49.2	50.5	+ 1.3
Denmark.....	29.84	29.89	+0.05	44.8	48.8	+ 4.0
France.....	29.77	29.89	+0.12	57.1	58.5	+ 1.4
Germany.....	29.81	29.91	+0.10	50.2	54.2	+ 4.0
India.....	29.76	29.71	-0.05	80.1	80.2	+ 0.1
Italy.....	29.81	29.90	+0.09	61.6	62.9	+ 1.3
Norway.....	29.91	29.85	-0.06	44.5	45.9	+ 1.4
Portugal.....	29.99	29.98	-0.01	60.2	59.7	- 0.5
Russia.....	29.89	29.98	+0.09	47.1	46.8	- 0.3
Spain.....	29.89	29.93	+0.04	62.0	59.6	- 2.4
Sweden.....	29.90	29.89	-0.01	38.9	41.2	+ 2.3
Turkey.....	29.87	29.96	+0.09	63.8	60.8	- 3.0

In North America, the temperature was above the normal, from Texas and the Mississippi river, eastward to the Atlantic, except in the Canadian maritime provinces, where it was slightly below the normal. Over the entire country west of the 100th meridian, it was below the normal, except in Kansas and Colorado. The greatest excess of temperature occurred in the middle Atlantic states, and the greatest deficiency prevailed in the Missouri valley. On the Pacific coast, the greatest deficiency occurred in the central region.

In central Europe, the temperature was everywhere above the normal, except in France, where it was slightly below, the greatest excess appearing in Austria and Germany. In Russia the temperature was below the normal.

The accompanying table shows the deviations in temperature and pressure at isolated stations for the month of April, 1880, as compared with the means of three years:

Comparative Thermometric and Barometric Means, with corresponding Departures.

STATION.	Mean Barometer.			Mean Temperature.		
	April, 1877-78-79.	April, 1880.	Departure.	April, 1877-78-79.	April, 1880.	Departure.
York Factory.....	30.10	30.08	-0.02	16.6	1.3	-15.3
Godthaab.....	29.91	29.84	-0.07	28.9	27.1	-1.8
Stykkisholm.....	29.87	29.62	-0.25	31.1	42.6	+11.5
Tromsø.....	29.88	29.67	-0.21	38.4	33.1	-5.3
Thorshavn.....	29.91	29.76	-0.15	42.8	46.2	+ 3.4
Archangel.....	29.94	29.84	-0.10	33.1	32.9	-0.2
Ekaterinburg.....	29.94	29.98	+0.04	41.8	36.9	-4.9
Barnaul.....	30.07	30.17	+0.10	39.1	31.1	-8.0
Yeniseisk.....	29.98	30.07	+0.09	30.9	32.2	+ 1.3
Nikolalevsk on the Amoor.....	30.06	30.10	+0.04	20.7	25.0	+ 4.3
Zi-Ka-Wei.....	30.06	30.10	+0.04	55.0	52.5	-2.5
Pekin.....	30.01	30.07	+0.06	58.4	56.8	-1.6
Beirut.....	29.92	29.81	-0.11	71.4	67.5	-3.9
Mauritius.....	29.89	29.03	-0.86	78.9	79.3	+ 0.4
Paramaribo.....	29.99	30.04	+0.05	81.2	81.1	-0.1
Funchal.....	30.14	30.15	+0.01	65.5	63.9	-1.6
Ponta Delgado.....	30.03	30.24	+0.21	64.1	62.2	-1.9
Bridgetown.....	30.02	30.02	Normal	83.4	80.2	-3.2
Navaes.....	29.96*	30.16	+0.20	80.2*	77.3	-2.9
Melbourne.....	30.15	30.12	-0.03	58.0	59.4	+ 1.4
Hobart Town.....	29.94	30.01	+0.07	62.9	57.1	-5.8
Astrakhan.....	29.95	30.09	+0.14	59.3	48.2	-11.1
Athens.....	29.86	29.93	+0.07	68.1	66.7	-1.4
Tiflis.....	29.88	29.97	+0.09	65.1	66.7	+ 1.6
Laghouat.....	30.03	29.96	-0.07	72.3	71.2	-1.1
Fort-de-France.....	29.84	30.22	+0.38	80.4	77.2	-3.2
Lisbon.....	30.00	30.02	+0.02	59.9	59.5	-0.4
Sandwich Manse.....	29.88*	29.78	-0.10	44.2	46.8	+ 2.6
Malta.....	29.87	29.91	+0.04	66.6	62.2	-4.4
Gibraltar.....	30.00	30.00	Normal	66.1	65.4	-0.7
Tashkend.....	30.04	30.04	Normal	66.1	62.4	-3.7
Cape Town.....	30.06	30.05	-0.01	72.8	70.3	-2.5
Angora.....	29.99	30.26	+0.27	60.6	63.3	+ 2.7
Agadir.....	29.81	29.87	+0.06	63.9	62.8	-1.1
Free Town.....	29.92	29.89	-0.03	87.5	87.4	-0.1
Madrid.....	29.89*	29.92	+0.03	80.4	86.3	+ 5.9
Nukuss.....	29.92	30.03	+0.11	68.1	67.9	-0.2
Nassau.....	30.03	30.15	+0.12	75.8	77.5	+ 1.7
Havana.....	29.96*	30.15	+0.19	75.9*	75.2	-0.7
Mexico.....	29.97*	30.12	+0.15	64.4*	63.8	-0.6
Lahore.....	29.86*	29.63	-0.23	89.5*	96.3	+ 6.8
Tokel.....	30.07	30.08	+0.01	63.1	62.0	-1.1
San Juan de Puerto Rico.....	30.00	30.12	+0.12	77.3	77.2	-0.1
San Jose de Costa Rica.....	69.3	66.6	-2.7

* April mean for two years only.

The following table shows some of the extreme monthly mean temperatures, reported from isolated stations:

LOWEST.		HIGHEST.	
Degrees.		Degrees.	
York Factory.....	+1.3	Freetown.....	87.4
Moose Factory.....	21.6	Manilla.....	83.1
Nikolalevsk on the Amoor.....	23.0	Paramaribo.....	81.1
Fort Garry.....	23.8	Bridgetown.....	80.2
Godthaab.....	27.1	Puerto Berrio.....	79.8
		Mauritius.....	79.3

In British India, the temperature was slightly above the mean, the highest monthly mean reported being 100° 8 (+38° 3 cent.) at Deesa, and the lowest, 75° 9 (+24° 3 cent.) at Sib-sagar.

The prevailing direction of the wind over North America, was, north of the fortieth parallel, northwesterly, except in the lake region and on the New England coast, where it was southwest and south or southwest respectively. South of the fortieth parallel, the prevailing direction was generally southerly and southwesterly; on the Pacific coast it was southeasterly, except at San Diego and Los Angeles, where the prevailing direction was northerly. In Canada the winds were northerly to westerly.

In Europe, the prevailing directions were as follows: In Germany, northerly to northeasterly; in France, northeasterly to northwesterly; in Austria, southerly to southeasterly; in Denmark, Sweden, and Norway, generally southwesterly. In Algeria, the winds were northwesterly; in Hindostan, northwesterly, and in China and Japan, they were generally northeasterly.

Over the north Atlantic, south of 35° N., and between 20° and 70° W., the winds were northeasterly; north of 35° N. and between 20° and 60° W., they were generally southwesterly.

and north of 30° N. and between 10° and 20° W., they were northeasterly.

The following brief notes, descriptive of the meteorological conditions over Europe, during the month, are gathered from the "Monatliche Uebersicht der Witterung:"

During the first week, the area of high barometer, which was central over Lapland, moved slowly eastward with increasing pressure, and formed steep gradients in connection with an area of low barometer then central over the British Isles and North sea. On the morning of the 3d, the barometer over the Hebrides was 29.13 (739.9); at Hernosand, it was 30.34 (770.6), and at Archangel 30.80 (782.3); southward, the barometer at Helgoland, was 29.41 (747.1); at Cherbourg, 29.65 (753.2), and at Biarritz 30.02 (762.5). Stormy easterly winds prevailed on the Norwegian and Swedish coasts, and strong westerly winds on the western coast of France.

The noteworthy features of the month were, first, the unusually large number of barometric minima which prevailed over northwestern Europe, but these were, in general of short duration, and developed only slight energy; they were accompanied in most cases by thunder and hail storms; second, the extreme high temperature recorded between the 15th and 24th of the month, in some cases, being as high as recorded during the summer months. The following maximum temperatures were reported in Germany: At Aschaffenburg, 82°.2 (27°.9 cent.); Berlin, 81°.3 (27°.4 cent.); Magdeburg, 79°.3 (26°.3 cent.)

From the 27th to the end of the month, the temperature fell rapidly, and severe frosts injuring vegetation, occurred throughout the northern part of central Europe. On the 29th and 30th, the minimum temperatures of the month occurred, 22°.1 (—5°.5 cent.), being reported from Oberweisenthal, (altitude of station, 927 metres, or 3041 feet), and 27°.9 (—2°.3 cent.) from Potsdam.

Chart v. exhibits the paths of barometric depressions which have been traced from the daily international charts for the month of July, 1880, supplemented by vessel reports from the north Atlantic.

The data are charted for each day of the month, on the charts accompanying the "International Bulletin" for that day, and from these charts and additional reports the movement of the centres of barometric minima are traced. Twenty-three storm-areas, occurring in the northern hemisphere, have thus been traced.

Concerning the general distribution of these depressions, the following is given:

Seven appeared in the United States and Canada, two of which are traced to the Atlantic, but, during this month, no storm appeared sufficiently well-defined, after leaving the American coasts, to warrant its being traced as a continuous storm across the ocean.

Twelve depressions appear over Europe, and these in general exhibited but slight energy during their prevalence.

Four depressions are traced in Asia, extending from the coast of China generally in a northeasterly course over Japan.

On this chart will also be found a tracing of the first typhoon that occurred in the China sea during the month of July, 1880, a detailed description of which is given below.

The following brief descriptions are given of the storms first appearing within the limits of the Signal Service stations:

I.—This depression was central in Kansas on the 1st, and during the 2d and 3d it moved in a north-northeasterly course towards lake Superior, and on the 4th it passed into the British possessions and beyond the limits of the stations of observations. During the early part of its course, this storm was accompanied by heavy rains and severe thunder-storms.

II.—This area probably developed in Colorado during the 3d, and on the 4th and 5th it moved in an east-northeasterly direction over the lake region, and thence down the Saint Lawrence valley, where it disappeared on the 6th. This storm exhibited considerable energy during its eastward movement

through Kansas and Nebraska, and was accompanied by severe thunder and hail storms. At North Platte, Nebraska, the wind reached a velocity of 80 miles per hour from the north-west, and heavy rains were reported from Dodge City, Kansas.

III.—This disturbance first appeared in Montana on the 6th, and, moving eastward at an average velocity of about 15 miles per hour, was probably central on the morning of the 8th, near Fort Garry, barometer 29.58 (m. m. 751.3), a fall of 0.30 inch in twenty-four hours. Continuing its course, which was now north-northeasterly, the centre was probably north of Moose Factory on the 9th. On the 10th, the storm-centre moved in a southeasterly direction over the Gulf of Saint Lawrence, and disappeared on the 11th over the Atlantic.

IV.—This depression first appeared in Utah on the 10th, and moved eastward during that day and the following, causing threatening and stormy weather in Colorado, Montana and Nebraska. The lowest pressures for the month occurred in the states just mentioned, during the passage of this storm. On the 12th, the depression moved northeastwardly and was central near Duluth. During the 13th, this low-area moved in a southeasterly direction over Lake Superior to the New England coast, and was attended by local rains and occasional high winds. On the 14th, the centre passed off the coast to about N. 43°, W. 60°, the U. S. ship "Portsmouth," in N. 42° 38', W. 60° 00', reporting barometer 29.57 (m. m. 751.1). wind ssw., force 5, raining. On the 15th, the storm pursued a north-northeasterly track and disappeared south of Greenland.

V.—This appeared in Manitoba on the 15th, and passed eastward with its centre north of the lake region on the 16th. On the 17th, it moved in a northeasterly course down the Saint Lawrence valley, and on the 18th, disappeared beyond the stations of observation.

VI.—This area probably developed during the 18th, and, on the 19th, moved by an easterly course through Iowa. Its course then changed to the northeastward, and, moving over the lake region on the 20th, its centre was near Rockliffe, Ontario, barometer, 29.68 (m. m. 753.9), a fall of 0.36 inch in twenty-four hours. During the 20th and 21st the centre moved northeastward, and disappeared beyond the stations of observation.

VII.—This depression developed north of York Factory on the 24th, and on the 25th and 26th it moved eastward over Canada. The path of this storm-centre was too far north to admit of its being more fully described.

The weather over the north Atlantic ocean during this month was unusually free from storms. West of the fiftieth meridian, high barometer, with light winds, prevailed, attended by occasional rains and thunder-storms.

Between 50° and 30° W. the winds were variable, and high barometer and generally fine weather prevailed. During the night of the 1st and 2d, in N. 36°, W. 37°, a hurricane occurred, lasting 2½ hours, barometer 29.72 (m. m. 754.9), wind s. to w. and nnw.

East of 30° W., the weather was generally fine, with fresh southwest and northeast winds and barometer generally high, except over the English Channel.

Of the storms occurring over Europe, the following is given, supplemented by notes from the "Monatliche Uebersicht der Witterung," published by Prof. Dr. Geo. Neumayer, director of the German Marine Observatory at Hamburg:

VIII.—This first appeared in Sweden on the 1st, and, pursuing a somewhat unusual course toward the northwest, passed into Norway, and on the 2d the storm was probably central near Bronø, barometer 29.48 (m. m. 748.7). The centre of disturbance then followed a northeasterly course toward Tromsøe, the barometer at that station reading 29.48 (m. m. 748.8) on the morning of the 3d. On the following day the storm passed in an easterly direction over the Arctic ocean.

IX.—This depression was central off the western coast of Scotland on the 2d, and moved across that country in an east-southeasterly direction towards the North sea, where it was central on the 3d. On the 4th, it reached the northwestern

coast of Germany, causing stormy westerly winds and rain. During the 5th and 6th, it passed over the southern part of Norway to the ocean, where it disappeared.

X.—This disturbance probably developed in the north of Scotland on the 7th, and during the 8th and 9th, it passed northeastward over the North sea to the Arctic ocean.

XI.—This was central near Yarmouth on the 9th, and moved in a northeasterly course along the coasts of Germany and Denmark. On the 10th, the centre was probably near Fanøe, and, continuing its northeasterly movement during the 11th and 12th, it passed through Sweden and Norway, and finally disappeared in Finland.

XII.—This storm first appeared on the 10th, near the Orkney Islands, and pursuing a northeasterly course, disappeared off the Norwegian coast on the 11th.

XIII.—This disturbance developed in northern Norway on the 15th, and moved by a southeasterly course across the White sea; on the 16th, the storm-centre was near Archangel, barometer 29.62 (m. m. 752.3), a fall of 0.20 inch in twenty-four hours. On the 17th, its course changed slightly to the northward, and on this day the storm probably disappeared in the valley of the Obi.

XIV.—This appeared in Scotland on the 18th, Glasgow barometer 29.82 (m. m. 757.4), wind west, squally; on the 19th the centre of disturbance crossed the North sea in an east-northeasterly course to Norway; passing thence southeasterly, it crossed the Baltic on the 20th, and was probably near Memel on the 21st. On the 22d the storm-centre reached Moscow, barometer 29.50 (m. m. 751.6), where it disappeared or became merged in low area xv.

XV.—This depression developed over the Black sea on the 18th or 19th, and moving northeastwardly, was central on the morning of the 20th, near, and north of Kasan, barometer 29.26 (m. m. 743.2). During the 21st, the storm apparently curved to the westward, and on the 22d was central near Archangel, barometer 29.28 (m. m. 743.7). On the 23d, the storm recurved and resumed its northeasterly course, disappearing in the valley of the Obi.

XVI.—This storm appeared on the western shores of the Black sea on the 23d, and on the 24th, was central over the sea of Azov. Following a northeasterly course during the 25th, 26th, and 27th, it was central near Ekaterinburg, 29.16 (m. m. 740.6), on the last-named date, and on the 28th, it disappeared in the valley of the Obi.

XVI.—On the 24th there was a decrease of pressure in southern Sweden, and on the 25th, and 26th, the disturbance passed into northern Russia, where it disappeared.

XVIII.—This depression developed over the north Atlantic ocean, south of Ireland, on the 26th, and, passing over England and western Europe at an average velocity of forty-five miles per hour, was central near Posen on the 27th, the barometer at that station reading 29.41 (m. m. 747.1). During the 28th and 29th, it followed an easterly course through Russia, and disappeared on the latter date.

XIX.—This storm apparently developed on the 27th, in about N. 47°, W. 18°, and, passing northeastward, skirted the west coasts of Ireland and Scotland. On the 28th, the centre was probably near Galway, barometer 29.47 (m. m. 748.5). On the 29th and 30th, it passed to the northward of the Shetland Islands, where it finally disappeared.

It is worthy of note, in connection with the storms occurring over western Europe during the month, that they were generally accompanied by severe thunder-storms and continuous rains, the rainfall for the month in northwestern Europe being slightly above the normal.

Of the storms appearing over Asia, the following is given:

XX.—This probably developed in the interior of China, and passed near Shanghai on the 6th and 7th, and was accompanied by severe thunder-storms and heavy rains. On the 7th and 8th, the storm moved slowly northeastward over Japan; at midnight of the latter date 0.31 inch of rain fell in fifteen minutes at Zi-Ka-Wei.

In connection with this depression, Mr. Marc. Dechevrens, of the Zi-Ka-Wei Observatory, reports the occurrence of a violent storm on the 4th and 5th:

The storm first appeared in the north-northwest and pursued a south-southeasterly course through the districts of Kwa-Chow, Chang-Choo and Yang-che-fou, in the province of Kiang-Su. During its path through these districts, it caused great destruction to life and property; churches were blown down and trees uprooted, city walls demolished and dwellings unroofed, and many persons were killed; several junks and other vessels were destroyed or damaged. The Chinese newspapers report a rain-fall of nine inches during the morning at Yang Chow. On the arrival of the storm at Shanghai, it appeared to have lost much of its energy, although still severe.

The above-mentioned storm does not appear on the international charts, but it is probable that it was closely connected with low area xx. during the early development of that storm.

XXI.—This disturbance appeared in the north of China on the 10th. Its influence was felt at Zi-Ka-Wei, where it caused heavy rains; during the 11th and 12th it passed north-eastward over Corea and Japan to the ocean.

XXII.—This depression developed to the east of Zi-Ka-Wei on the 21st and 22d, and passed thence northeastward over southern Japan; Nagasaki barometer, 29.47 (m. m. 748.5). It passed over the island of Nippon during the 23d, and was probably near Tokei on that day; on the 24th it disappeared northeastward over the ocean.

XXIII.—This apparently developed in the region northwest of Zi-Ka-Wei during the 22d, and following a south-southeasterly course, was central on the 23d in about N. 30°, E. 126°. Its course then changed to the eastward, and the storm-centre passed south of Japan on the 24th; on the 25th it was probably central near N. 33°, E. 135°, the U. S. steamer "Richmond" reporting in N. 34°, E. 135°, barometer 29.58 (m. m. 751.3). During the 26th and 27th, it passed northeastward and disappeared on the latter date.

In connection with the weather in China, during the month under consideration, may be mentioned the prevalence of northeast winds. The means of seven years show the resultant direction of wind in July to be southeast, while the mean direction during the present month was northeast. Instead of the usual torrid heat, the month was relatively cool and agreeable.

The following description of the first typhoon of July 1880, is taken from the "Bulletin Mensuel" published Mr. Marc Dechevrens of the Zi-Ka-Wei Observatory:

This typhoon prevailed from the 13th to the 19th, and probably developed between the islands of Borneo and Mindanao. It followed a northwesterly course, crossing the parallels of 10° and 20°, the first in longitude 120° E., and the second in 107° E., and traversed the island of Hainan and the Gulf of Tonquin.

Its average velocity was eight miles (thirteen kilometres) per hour, which is about the usual velocity of the southern typhoons. It will be noted that the velocity and direction of the movement of this typhoon, contrasts strongly with those of the atmospheric disturbances of the interior and north of China.

Notwithstanding its proximity to Manila and its slow movement, this typhoon was almost imperceptible to the inhabitants of that place. On the 14th, when the typhoon was central near N. 15°, the barometer at Manila, which had remained almost stationary during the preceding forty-eight hours, began to rise, and it is probable that its slight oscillations during the forty-eight hours indicated the slow movement of the storm and that its track remained at the same distance from Manila. The east and southeast winds which prevailed at Manila before the passage of the centre were very light; after the centre had passed, the wind changed to southwest, 13 miles per hour. The storm crossed the Gulf of Tonquin without developing much energy, but the ship "Fabius," which left Hong-Kong on July 15th, for Cochin-China, probably experienced the full force of the typhoon, as she returned to Hong-Kong, dismasted, on the

20th. At noon of the 17th, this vessel was in N. 18° 41', E. 111° 44', wind blowing from the north with extreme violence, barometer 29.68 (753.9), and falling; at midnight of the 18th, the barometer reached its minimum, 29.42 (747.2), and the wind shifted by west to southwest.

OCEAN ICE.

May 22d: bark "Emilie," in N. 43° 42', W. 48° 36', passed hundreds of icebergs and a large ice-field extending from ene. to wsw.

23d: bark "Amaranth," in N. 44° 00', W. 46° 50', passed three icebergs from forty to fifty feet high; 24th, from N. 43° 05', W. 42° 30' to N. 42° 30', W. 50° 30', passed sixty icebergs, some of which were seventy to ninety feet high, and from four hundred to five hundred feet long; 25th, in N. 42° 00', W. 51° 20', passed three icebergs.

27th: s. s. "Elbe," in N. 41° 51', W. 48° 39', passed two icebergs; in N. 41° 46', W. 50° 37', passed one iceberg.

28th: ship "Saint Nicholas," in N. 42° 40', W. 40° 00', was in the ice for twenty-four hours.

29th: ship "W. R. Grace," in N. 41° 28', W. 47° 50', passed remnant of an iceberg; s. s. "Lessing," in N. 40° 46', W. 47° 35', passed several large icebergs.

30th: s. s. "Circassian," in N. 47° 35', W. 57° 05', passed a number of icebergs.

31st: bark "Scotland," in N. 41° 11', W. 46° 55', passed a large iceberg; in N. 40° 58', W. 48° 02', passed two icebergs.

June 1st: s. s. "Britannic," in N. 42° 40', W. 50° 38' and N. 42° 30', W. 52° 02', passed several icebergs, some very large; s. s. "Coventina," in N. 40° 56', W. 46° 08', passed an iceberg; s. s. "England," in N. 41° 44', W. 47° 34', passed a very large iceberg; s. s. "Heckla," in N. 42° 29', W. 53° 08', passed several icebergs; s. s. "The Queen," in N. 41° 28', W. 48° 00', passed several icebergs; s. s. "Lepanto," from N. 42° 30', W. 49° 00' to N. 42° 30', W. 53° 00', passed numerous icebergs.

2d: s. s. "Coventina," in N. 42° 48', W. 51° 15', passed two very large icebergs; s. s. "Devonia," in N. 43° 40', W. 46° 53', passed two small icebergs.

3d: s. s. "City of Montreal," in N. 41° 16', W. 47° 27', passed a large iceberg with several large pieces of ice floating around it; s. s. "Devonia," in N. 42° 24', W. 51° 15', passed a large iceberg; in N. 42° 24', W. 51° 28', passed one large and two small icebergs; in N. 42° 24', W. 51° 55', passed three large icebergs; s. s. "France," in N. 42° 21', W. 51° 05', passed a number of large icebergs; s. s. "Frisia," in N. 42° 37', W. 47° 08', passed an iceberg about two hundred feet high; in N. 42° 06', W. 49° 04', passed two icebergs; s. s. "State of Nebraska," from N. 53° 56' 1/2, W. 49° 12' to N. 43° 37', W. 50° 50', passed large numbers of icebergs; bark "Scotland," in N. 41° 48', W. 51° 48', was surrounded by a great number of large and small icebergs.

4th: s. s. "Belgenland," in N. 40° 18', W. 48° 50', passed a large iceberg; s. s. "Pollux," in N. 44° 41', W. 51° 31', passed several large icebergs.

5th: s. s. "Adriatic," in N. 42° 10', W. 48° 30', passed a small iceberg; in N. 42° 05', W. 49° 00', passed an iceberg; s. s. "Main," in N. 42° 43', W. 47° 16', passed an iceberg about two hundred feet high; in N. 42° 13', W. 48° 06', passed one large and two small icebergs; in N. 41° 56', W. 50° 03', passed a small iceberg.

6th: Ship "Larnica," in N. 44° 26', W. 42° 50', passed an iceberg.

7th: s. s. "Westphalia," in N. 41° 20', W. 47° 25', passed an iceberg.

9th: Bark "Petunia," at St. Johns, Newfoundland, reported having sighted 932 icebergs between N. 44° 00', W. 43° 20' and the Cape Race coast; s. s. "Cassius," in N. 45° 00', W. 44° 36', passed several icebergs; s. s. "Irthington," in N. 41° 50', W. 48° 16', passed two large icebergs; ship "Larnica," in N. 44° 00', W. 48° 30', passed six icebergs; bark "Alice M. Claridge," off the Banks of Newfoundland, passed seven icebergs and a quantity of drift ice.

10th: s. s. "America," in N. 42° 30', W. 50° 36', passed through a fleet of icebergs, some of which were three hundred feet high; s. s. "Bohemia," in N. 42° 12', W. 50° 00', passed a number of icebergs; s. s. "Cassius," in N. 42° 35', W. 48° 30', passed seven large icebergs from one hundred and fifty to three hundred feet high; s. s. "Wieland," in N. 42° 46', W. 46° 22', passed an iceberg about fifty feet high; bark "Heinrich and Antoine," in N. 41° 55', W. 51° 20', passed two icebergs.

11th: s. s. "Alhambra," twenty miles ene. of Cape Race, met several icebergs; 11th to 13th, s. s. "Abyssinia," from N. 42° 04', W. 49° 13', to N. 42° 37', W. 52° 57', passed several icebergs; s. s. "Istrian," in N. 42° 30', W. 50° 00', passed several icebergs and considerable drift ice; s. s. "Thingvalla," in N. 44° 00', W. 45° 00', passed three large icebergs; s. s. "Wieland," in N. 42° 28', W. 50° 20', passed an iceberg; in N. 42° 21', W. 45° 27', passed two icebergs.

12th: s. s. "Edam," in N. 43° 38', W. 48° 50', passed a small iceberg; bark "Marco Polo," in N. 44°, W. 45°, passed several large icebergs.

13th: s. s. "Edam," in N. 42° 50', W. 48° 50', passed a large iceberg; ship "John Harvey," in N. 41° 00', W. 48° 20', passed a large iceberg.

15th: s. s. "Bulgarian," from N. 43°, W. 48° to W. 50°, passed fifty or sixty icebergs, large and small, extending north and south as far as could be observed; bark "Quebec," in N. 43° 36', W. 57° 00', passed twelve icebergs.

17th: s. s. "Colina," at Saint John's, Newfoundland, reported numerous icebergs from Cow Bay to Cape Race; s. s. "Scythia," in N. 43° 18', W. 48° 05', passed an iceberg, also in N. 42° 19', W. 50° 52', passed a large iceberg.

18th: bark "Sendemanden," at New York, from Trieste, reported a large iceberg in N. 39° 34', W. 38° 46'.

21st: s. s. "Ashdrubal," struck an iceberg twenty miles off Cape Race, and sank.

24th: s. s. "Bothnia," in N. 42° 37', W. 49° 48', passed several large icebergs.

25th: s. s. "Bristol," in N. 43° 15', W. 49° 10', passed an iceberg; s. s. "De Ruyter," in N. 43° 33', W. 50° 40', passed a large iceberg.

The following extract of a communication by Mr. E. Douglas Archibald, published in "Nature," contains valuable information bearing on the subject of ocean ice:

"In view of the recent unusually cold weather in England and Scotland, which has been so well described and proximately explained in last week's 'Nature,' the following paragraph, extracted from the 'Standard' of June 15th, appears to me highly suggestive, especially as regards one of the probable causes for the 'unwonted high pressures' on the northern side of the depression, which is accused of being the immediate source of these unseasonable conditions:

'News from Iceland states that the Spitzbergen floe-ice surrounds the north and east coast, entirely preventing navigation. A Norwegian steamer, endeavoring to reach Bernfjord, on the southeast coast, last week, was caught in the ice and had to put back. Owing to the presence of these immense ice-fields, vegetation has made no progress, causing a great loss of horses and sheep through starvation. Epidemics of measles and smallpox have been introduced into the island from Europe, and are making extensive ravages among the population; the former is especially prevalent in Reikjavik.'

"Now it has been ascertained, with some considerable degree of certainty, by Messrs. Blanford and Elliot, the government meteorologists in India, that a heavy winter snowfall over the northwest Himalaya exercises a marked and prolonged influence in lowering the temperature and elevating the atmospheric pressure, and thereby directly affecting the winds and weather over the whole of northern India and parts of central India; and indirectly to a much greater distance. Turning to Europe, we find the distance from Reikjavik, on the west coast of Iceland, to London is about 1140 miles, or about the same as from Lahore to Calcutta (1080 miles), while from

Cape Horn, on the east coast of Iceland, to Edinburgh the distance is only seven hundred and fifty miles, or about the same as from Calcutta to Agra. To any one familiar with Indian weather charts or the meteorology of that country, it would appear absurd not to attempt to correlate the meteorological conditions at places so comparatively near as the above-mentioned towns; and, in fact, experience has shown that the meteorology of the Punjab is not only intimately connected with that of lower Bengal, but also with that of southern India. If, therefore, it has been found that an abnormally heavy snowfall in the northwest Himalaya, such as that which characterised the winters of 1876-77, and 1877-78, exercised a marked effect on the meteorology of northern India, which was felt at places situated 1000 miles or more from the seat of action, may it not be reasonably inferred, that the presence of a large mass of ice and snow in the Icelandic area would be likely to give rise to similar atmospheric conditions over these islands? It seems, therefore, not at all improbable, that the abnormal weather during the past few weeks, may be directly due in some considerable measure to the coincident appearance of large masses of ice off the eastern coasts of Iceland, like those which, from the account in the 'Standard,' appear to be at present prevailing to an unusual extent.

"In the case of India, an abnormally heavy fall of snow in the Himalayan zone is found to be associated, not only with the subsequent conditions already named, but also with an *initially*, and therefore according to experience, *subsequently* weak, southwest monsoon, which in its turn, invariably causes local, if not general drought and famine. These heavy snowfalls are found to have a tendency to recur at the minimum sun spot epochs, and are proximately due to some condition of the upper anti-monsoon current, at present not exactly known, by which a larger amount of vapor is deposited in the winter, on the Himalaya as snow, and on the north Indian plains, as the winter rains.

"It does not appear that we can so readily account for the occurrence of the present ice-floes off Ireland, or for the large masses which have been encountered this spring, in the western Atlantic. They must, however, to some extent be due to the unusually warm winter which seems to have prevailed pretty uniformly over the north Atlantic and northwest Europe, and which has detached a larger proportion than usual, of the arctic ice-fields. And though it is improbable that we shall find any such regular periodicity in the amount of these ice-floes in the Atlantic, as in that of the Indian winter snows and rains, it is worthy of notice to observe that they have a decided tendency to occur to an unwonted extent about the times of maximum sun-spot—like the present. Thus, Professor Fritz, of Zurich, gives the following as the list of years in which floating ice was found most abundantly in the lower latitudes of the north Atlantic:—

Years of greatest frequency of floating ice.	Epochs of maximum sun-spot.
1789	1788.1
	1804.2
1816-18	1816.4
1828-29 }	
1831 }	1829.9
	1837.2
	1843.1
1862-64	1860.1
1868 }	
1869 }	1870.6

"It is also interesting to notice that in 1862, Heis's 'Wochen-schrift' mentions that the floating ice-masses in the Atlantic, caused 'a noticeable cooling of the weather in June, over Europe.' And it is further significant to find in a detailed list of the ice met with every month in the Atlantic, by ships belonging to the North German lines, from 1860 to 1869, that in 1868 and 1869, (the year in which similar weather to the present is mentioned as having been observed by the writer of the paragraph in 'Nature') were the years in which the greatest quantity of ice was encountered. Though I agree with Dr. Hann in attributing more importance to the *tropical* than to

the *polar* area, in influencing the *general* weather of these latitudes, I think it very probable on theoretical grounds, that we are relatively more influenced by the *latter* area in *summer*, and by the *former* in *winter*, and that, just as it has been inferred, that the regular recurrence of periods of diminished temperature in Europe, is due to the regular movements of the ice in the polar area, so we may reasonably conclude that abnormal movements of the ice, especially in the Spitzbergen area, are likely to produce periods of abnormal coolness such as that which at present prevails. In any case, the moral to be drawn, if we really do intend to solve the weather problem, is by all means to have a meteorological station in Iceland, and endeavor to study the weather, as we are fortunately able to do in India, on a *large scale*, instead of merely confining our attention to the minute range of conditions we are able to observe within the limited area of these islands."

TEMPERATURE OF THE AIR.

The distribution of mean temperature over the United States and Canada for the month of June, 1882, is exhibited by the dotted isothermal lines on chart ii. The table of mean temperatures at the lower left-hand corner on chart ii. shows the average temperature which prevailed in each district during the current month, compared with the mean temperature of each district, as determined from observations taken at Signal Service stations during the corresponding month of the past ten years.

The temperature has differed slightly from the normal in the districts on the Atlantic coast, the excess being only one-tenth of one degree in the middle states and two-tenths in New England. In all other districts east of the Rocky mountains, the temperature has ranged from one to two degrees below the normal, except in the Missouri valley, where it is slightly above the normal for the month. On the Pacific coast, the temperature was about two degrees below the normal in California, and slightly above in Oregon and Washington territory. At the station on the summit of Mount Washington, it was one and eight-tenths degrees below, and on the summit of Pikes' Peak, it was three and four-tenths degrees below the mean for the month.

DEVIATIONS FROM MEAN TEMPERATURE.

Under this heading, departures exhibited by the reports from the regular Signal Service stations are shown in the table of comparative temperatures on the left-hand side of chart ii. The following items of importance, in connection with this subject, are reported by voluntary observers:

Illinois: Riley, mean temperature 63°.7, or 2°.9 below the mean of past twenty-one years. During that period, the only June mean temperature lower than that of the present year, occurred in 1869.

Kansas: Wellington, mean temperature 72°.5, or 3°.2 below the average of past three years. Yates Centre, mean temperature 74°.6, or 0°.4 below the average of past two years.

Maine: Gardiner, mean temperature 61°.94, or 1°.45 below the average of the past forty-six years.

Maryland: Fallston, mean temperature 70°.36, or 0°.25 below the average of the past eleven years. During that period, the highest means, 72°.40, 72°.61, and 72°.17 occurred in 1871, '74 and '76 respectively; the lowest, 67°.42, occurred in 1881.

Missouri: Saint Louis, "Missouri Weather Service" "mean temperature differs but little from the average of reports, past forty years."

New York: North Volney, mean temperature 62°.82, or 2°.22 below the average of the past thirteen years. During that period, the lowest mean temperature, 58°.68, occurred in 1881; the highest, 71°.59, occurred in 1870. Palermo, mean temperature 62°.4, or 1°.9 below the average of the past twenty-nine years. During that period, the highest monthly mean, 71°.6, occurred in 1870; the lowest, 59°.3, occurred in 1855.

Vermont: Woodstock, mean temperature 64°.27, or 0°.78 above the average of the past fifteen years. During that period, the highest June mean, 67°.07, occurred in 1876; lowest,